ENTOMOLOGICAL SOCIETY
OF BRITISH COLUMBIA

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

BRITISH COLUMBIA

MARCH 1917
NUMBER 10
SYSTEMATIC SERIES

VICTORIA, B. C.:
PRINTED BY THE COLONIST PRINTING AND PUBLISHING CO., LTD.
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E. H. BLACKMORE,

President, Entomological Society of British Columbia, 1916-1917

BRITISH COLUMBIA ENTOMOLOGICAL SOCIETY

PROCEEDINGS, 1917

The Sixteenth Annual Meeting of the Entomological Society of British Columbia was held in the Provincial Museum, Parliament Buildings, Victoria, B.C., on March 17th, 1917.

The meeting was called to order by the President, Mr. E. H. Blackmore, of Victoria, at 9.30 a.m., and was one of the best that the Society has ever held. The large proportion of active workers present, the enthusiasm displayed, and the spirited discussion on many of the papers read being very gratifying to those officers of the Society who were responsible for the getting up of the programme.

The report of the Secretary-Treasurer was highly satisfactory, and showed, amongst other things, an increase of membership and a very large correspondence, which told of the interest taken by many outside institutions and individuals in the activities of the Society.

Eleven papers were read, six being on systematic lines, five on economic subjects, and one of general interest.

The day's proceedings closed at 6 p.m., when the election of officers for the year 1917 was proceeded with, and resulted as follows:

Hon. President—F. Kermode, Provincial Museum, Victoria, B.C.

President—E. H. Blackmore, Victoria, B.C. (re-elected).

Vice-President (Coast)—R. S. Sherman, Vancouver, B.C. (re-elected).

Vice-President (Interior)—L. E. Taylor, F.Z.S., Vernon, B.C. (re-elected).

Secretary-Treasurer—Williams Hugh, Box 20, Cloverdale, B.C.

Advisory Board—A. E. Cameron, M.A., D.Sc.; Geo. O. Day, F.E.S.; Seymour Hadwin, D.V.Sc.; and R. C. Treherne, B.S.A., in addition to the officers above mentioned.

PRESIDENTIAL ADDRESS

By E. H. Blackmore, Victoria, B.C.

In welcoming you to the Sixteenth Annual Meeting of our Society, it is my sad and painful duty to call attention to the deaths of three of our members that have occurred since our last meeting.

I refer to the deaths of Mr. A. H. Bush, Mr. E. Baynes Reed, and Mr. Tom Wilson, in the order in which they occurred. More competent hands than mine will pay worthy tribute to each of them, but I would like to say a few words of personal appreciation.

Mr. Bush was one of the original members of our Society when it was formed in 1901, and was elected Vice-President in 1908.

He was one of our most active members, and built up an interesting collection of Lepidoptera which contained many records new to British Columbia, mostly taken on Mt. Cheam, the ascent of which mountain he made on many occasions. He contributed papers, chiefly on Mountain Fauna, at our annual meetings in 1912, 1913 and 1914.

He had a pleasing personality, and was well liked by all those with whom he came in contact. As you all doubtless know, he fell while fighting for his King and Country on the blood-stained battlefields of France in August, 1916.

Mr. Baynes Reed, who was elected Honorary President of our Society in January, 1913, was one of the oldest entomologists in the Dominion of Canada, having joined the Entomological Society of Ontario on its inception in 1863, and in the succeeding 25 years before his removal to Victoria, he held at different times the positions of Vice-President, Secretary-Treasurer, Librarian, Curator and Auditor. He wrote many articles on economic entomology, and was a constant contributor to the Canadian Entomologist. He passed away at his home in this city on November 18th last, after a long illness, at the advanced age of 79. A fitting tribute to his memory is penned by his life-long friend, Rev. J. C. S. Bethune, in the Canadian Entomologist for February, 1917.

It is with deep and sincere regret that I have to refer to the tragic fate which overtook Mr. Tom Wilson, on the morning of March the 6th. He was also one of our original members, and was elected President at the resuscitation of our Society in December, 1911. He was an ardent entomologist and botanist, being especially interested in Scale Insects and the distribution of the Tent-caterpillar in this Province, and we always looked forward to an interesting paper by him at our annual meeting. He was one of the most genial, generous and warm-hearted men that I ever met, and in him the Dominion Government has lost a most faithful and conscientious servant, and our Society one of its most valued members.

In passing, I think it is only right to mention the heroic death of Sergt.-Major W. T. Taylor, the youngest son of the late Rev. G. W. Taylor, who was the President of our Society for so many years. Sergt. Taylor was only twenty years of age, and while leading his men during an attack on an enemy position, he was struck by a piece of shrapnel and his left arm torn off. Despite this terrible injury, he urged on his men to greater efforts, while he lay in a shell hole. After the assault on the enemy had been successfully effected, he was rescued but spurned assistance, saying that there were others who needed it worse than he. He died shortly afterwards, alone in his dugout, from loss of blood. He was educated at Mount Tolmie University School, and was a pupil of the late Captain Harvey.

At this, our annual meeting, it will be only fitting for us to pass a vote of condolence to the families of the deceased gentlemen.

During the past season the Dominion Government appointed Dr. A. E. Cameron on a special mission to investigate the ravages of the Pear Thrips on the Saanich Peninsula, and I wish to welcome him amongst us, and to take this opportunity of extending the good wishes of the Society towards him. Perhaps you are not all aware of the great success that attended the work of Dr. Cameron and Mr. Treherne amongst the Pear Thrips during the past year.

I believe I am right in stating that, owing to their efforts in this direction at Mr. Bryden's orchard at Royal Oak, there was the biggest crop of fruit produced in many years, notwithstanding the adverse weather conditions encountered in the early part of the season. Dr. Cameron has become a member of our Society, and will be a great acquisition to us and a source of strength to the entomology of the Province.

He has offered to help any of our members who are desirous of going deeper into the studies of our local insects, and I look forward to Dr. Cameron's assistance with great interest, assistance which will be invaluable to those of us who intend to study the biology and taxonomy of our insect fauna.

While I am on this subject, I would like to draw the attention of our Society to the excellent work that our worthy Secretary, Mr. R. C. Treherne, has done on that destructive pest the Cabbage Root Maggot. A very excellent bulletin, comprising 58 pages and 27 original illustrations, entitled "The Cabbage Root Maggot and its Control in Canada," was issued by the Dominion Department of Agriculture last April, written by Messrs. Arthur Gibson and R. C. Treherne in collaboration, which covers every phase of the subject, and I think that we, as a Society, should congratulate our worthy Secretary as junior author of such an important contribution to economic entomology.

Speaking of entomological literature reminds me that I would like to say a few words regarding two Monographs recently published in the State of Illinois. The first was issued in July, 1915, by the University of Illinois, and is the work of Stanley B. Fracker. It is entitled "The Classification of Lepidopterous Larvae," and carries to a successful conclusion the preliminary work done by Dr. Dyar and others. It is a very clever piece of work and wonderfully well thought out. The chief structures of value in the classification of the larvae, are the position of the setae, the shape of the spiracles, the number of prolegs and the arrangements of the crochets they bear.

The other Monograph was published by the Illinois State Laboratory in March, 1916, and is entitled "The Classification of the Lepidoptera based on Pupal Characters," by Dr. Edna Mosher, and is a really important addition to entomological literature, as previous to this publication very little had been done in this particular line of research. Some of the chief characters used for determining the phylogeny of the order are the number of movable segments, the freedom of the appendages, the number of sutures present in the head, and the relative length of the body segments. It has been found in some orders that the only good taxonomic characters available are found in the pupal stage of the insect. These two publications, taken together, afford much food for thought both to systematic and economic entomologists.

It is of special interest to the economic entomologist, as he early realizes the value of being able to recognize the immature stages, for in many orders of insects the larval stages alone are responsible for a great deal of the damage done to crops and orchards.

At present, in many cases, he has to content himself with rearing the adult forms to determine the species, and thereby possibly losing a lot of valuable time. To those of us that are systematists, it is very evident that the classification of Lepidoptera based upon characters that are only present in the adult forms, must necessarily be arbitrary and artificial, and that to get a natural classification we shall have to study in conjunction characters that appear in the larval and pupal stages as well as those in the adult insects, and also the inter-relationships of one to the other.

The new check list of North American Lepidoptera issued by Drs. Barnes and McDunnough, which we have all been waiting for, was published last week. There are a large number of additions and a great many changes in nomenclature. The arrangement of genera is also entirely different to what we have been accustomed. I must say that, on a cursory glance through its pages, the numerous shiftings of species into different genera is a great improvement on previous lists, and that the arrangement in general seems to me to be a great step towards a more natural arrangement of the species.

With the valued assistance of our energetic Assistant Secretary, Mr. Williams Hugh, I instituted a series of monthly meetings, beginning with the New Year. We held one in January and another in February, both of which were attended by about nine of our local members, and a great deal of interest was shown at both meetings in the subjects under discussion. It is our intention to hold these meetings the second week in each month throughout the year, and to make them as interesting and instructive as possible, especially to the younger members of our Society.

I have not taken any set subject for my address, but am contenting myself with making a few general remarks on different subjects that I wish to speak of, and this seems to me the most convenient opportunity of expressing myself to you. I would like to say here that these remarks are not made in any spirit of criticism but are made solely with the idea of improving the collections of the systematic entomologists of British Columbia.

During the past four years, as most all of you know, I have been studying the Geometridae of British Columbia. In the course of my studies I have examined about fourteen collections, both on the Island and the Mainland. Many of these collections had neither date nor locality labels; some of the insects were on short pins, others low set on long pins; again others were badly set and badly arranged, and in a few instances the presence of mites and dermestes was very evident.

Noticing all these things made me feel that if I were permitted to draw the attention of our systematic collectors to these several defects, a more uniform standard could be attained in the display of our collections. This may seem to many of you a trivial matter, but I can assure you from the remarks of Mr. Wolley Dod and other eminent entomologists, that it is a matter of the utmost importance, both to the collector himself and more especially to others who may either want to exchange material, or for comparison to settle some disputed point.

I was very sorry to see so many collections without date labels of any kind, as the value of labelling at the time of capture cannot be too strongly impressed upon all collectors. It has been truly said that at times a label without an insect is of more value than an insect without a label. A small printed label not only adds to the appearance of a collection but in many cases is the only means of a ready identification of specimens. To illustrate what I mean, I will give an example as regards the value of a date label. We have on Vancouver Island two geometers that are almost exactly alike, **Hydriomena irata** and **Hydriomena californiata,** so close in fact that if there were no labels on them only an expert could tell which was which, but when properly dated can be easily separated, as **irata** occurs in April while **californiata** does not emerge until June.

An example of the value of locality labels occurs in the common sulphur butterfly of the eastern states, **Eurymus philodice,** the points of difference between this and its western representative, **Eurymus eriphele,** are so slight that without locality labels no one but a close student of this genus could tell one from the other. As any one can get these labels printed with locality and collector's name in 3 point type for the small sum of 25 cents per thousand, there is no reason why every collector should not have a supply of these on hand.

Low setting has fallen into disuse in nearly all countries, with the exception of the British Isles. It has many disadvantages as compared with high setting, chief of which is the greater danger to the attack of insect pests, and in those species which are liable to "grease," the danger of the grease spreading to the lining of the box and ruining the whole of the specimens contained therein is very great.

Now as to arrangement, I have seen collections of Lepidoptera beautifully set and labelled correctly, but badly mixed up—diurnals, noctuids and geometers all in one box; genera split up, some in one box, some in another; and even specimens of the same species scattered through two or three different boxes. The result of this haphazard arrangement is that when one wants to show a fellow-collector a certain group or even a certain species, one has to hunt through half a dozen boxes or drawers, as the case may be, before finding them. It is time well spent to go over one's entire collection every winter and arrange it in accordance with the list which is the recognized standard of the time. We should have no difficulty as regards this from now on, as the new check list just published will probably be the standard list for a great many years.

As regards insect pests in our collection, immediate steps should be taken to exterminate them at the very first sign of their presence. Nothing is more sure or certain than a tablespoonful of bisulphide of carbon in a small container, and placed in the box or drawer and left for twenty-four hours. All exchanges should be subjected to this process before being placed in our cabinets, as very often pests are introduced into our collections by specimens from outside sources.

I would also like to ask our more active members to study their insects more in the leisure hours of the winter months. I am sure many interesting points would be discovered and many mistakes rectified. I have seen in several collections different species listed under the same name, in some cases as many as three, and in one case four; also the same species listed under two different names, and so on. I think in cases like this a little more care and study would eliminate these mistakes.

I would be sorry to see the collection of any member of our Society come under the scathing indictment made by Mr. Wolley Dod on the

Heath Collection of Lepidopters, which appeared in the Canadian Entomologist for May, 1916. In support of my remarks to you this morning, I would like to give a few brief extracts from the article in question. As some of you probably know, the late Mr. E. F. Heath was a resident of Cartwright, Manitoba, and collected there for about 35 years. At his death, his collection was acquired by the Manitoba Government, as a nucleus for the entomological section of the Provincial Museum.

Mr. Wolley Dod was given an opportunity of looking over it last December, and this, in part, is what he says: "Viewed as a whole the collection was in poor condition. The percentage of worn or indifferent specimens was high, and with a very few exceptions, the setting was badly done on short pins. A portion, and only a portion, of the specimens bore date labels, usually face downwards." Again he says: "Heath, though a most energetic collector, had unfortunately a poorly developed faculty for recognizing a species. We frequently found a series of good specimens standing as one species, a series of bad specimens of the same as distinct, and perhaps a series of smaller specimens of the same thing as something else. Nor was that all, besides the frequency with which one species stood for two or more, it was deplorable the number of very distinct and often dissimilar species which were arranged in one series under the same name. In short, the errors and mixtures were appalling."

Now, that is a pretty severe indictment of a man who had been collecting for 35 years. There is no reason why any of our members should lay themselves open to an attack of this nature. There is a good collection of Lepidoptera in the Museum, which is available at any time during the day, and my own private collection is open at all times for inspection and comparison to any of our members who care to avail themselves of it.

In conclusion, I would like to appeal to all our members to do some one thing or other during the coming season to advance the knowledge of the entomology of this Province, either by recording life histories of species, by the breeding of rare or uncommon forms, by making ecological notes of all rare or uncommon species they may happen to capture, or by taking interesting and uncommon forms in other orders than those in which they happen to be interested, and giving those specimens to members who are making a special study of them.

Dr. Hewitt, the chief entomologist of the Dominion, paid a brief visit to this city last June, during which I had the pleasure of spending an evening with him, and he wished me to convey to you his hearty appreciation of the work our Society was doing. As your President, it is my earnest desire to maintain this work, and that is why I ask all

of you to do something, however little, to keep up the reputation that we have gained.

We have the finest field in the Dominion of Canada for the prosecution of our studies, and there are many perplexing problems waiting to be solved. In **Leptarctia californiae** and its varieties, to determine if any males can be produced that have red secondaries; all the males that I have seen have yellow ones and the females red, although Dr. McDunnough assures me that he has a red male. In the genus **Alypia,** Sir George Hampson, in his synopsis of the species, differentiates between **octomaculata** hind wings marked with white and **langtoni** hind wings marked with yellow. The species that we have are all listed under the name of **langtoni,** although in all the specimens that I have seen the males have hind wings marked with white and the females marked with yellow. By breeding we could determine if this was only a sexual and not a specific difference. Again we have a species called **Hadena arctica,** which Dr. McDunnough claims to be a variety of **Hadena castanea.** I am of the opinion that it is a western race of the eastern **arctica,** but by breeding **castanea** and so called **arctica** from the eggs of known females, this point could be definitely settled for all time. There are a number of other instances which I could give you along the same lines, but I think these are sufficient to show you that if our systematic members would each take up one of these subjects and carry it to a successful conclusion, they would accomplish something that would add to their credit and be of great taxonomic value to the entomology of Boreal America.

NOTES ON THE LEPIDOPTERA OF THE NORTHERN OKANAGAN

By W. Downes, Victoria, B.C.

During a residence of several years' duration in the vicinity of Armstrong, in the Northern Okanagan, a small collection of Lepidoptera was made by the writer, and the following brief notes may be of interest to those who have not had the opportunity of visiting this favoured district and obtaining first-hand knowledge of its rich insect fauna.

Travelling northwards from Vernon, a point is reached about 12 miles from that city, where the open range country ends rather abruptly and the hills are principally forest-clad, with here and there patches of open grass land, while on the lower levels there are extensive areas of heavy bush, indicating a moister climate, the precipitation in fact in this district being about double that of the range country to the south. This region may be roughly described as being triangular in shape, the base of the triangle extending from Sicamous, on the main C.P.R. line, to rather beyond Salmon Arm, and the apex at Armstrong. The visitor will find that this district presents faunal characteristics very different from the drier range country to the south and west, the varied flora is at once apparent, and from the point of view of an entomologist the region is one of surpassing interest. For the most part the country consists of broad valleys interspersed with low hills, but it is flanked at the east by high mountains rising to a height of about 4000 feet, on which many high-altitude species may be obtained, not to be found on the lower levels. The collection brought by me to the Coast this year is not a large one and contains only about 300 species, but it is fairly representative and includes some rare forms and several new records for the Province.

With the first warm days of spring **Papilio zelicaon.** Luc. makes its appearance, followed at no great interval by **P. glaucus** race **canadensis,** which is one of the common butterflies of the Interior. The magnificent **P. daunus.** Bdv. does not usually appear until June, but I have taken it once as early as May 12th. **P. bairdi** race **oregonia.** Edw. is not so frequently met with in the bush districts as on the range land to the south, where it is fairly plentiful in July. **Parnassius smintheus** race **magnus** is somewhat local, but where found is usually abundant. **Neophasia menapia.** Feld. is taken but rarely, being more abundant in the Southern Okanagan.

Among the sulphurs, **Eurymus eurytheme** form **kootenai** Cockle is common in spring. The form **eryphyle** Edw. appears in the first week in July, followed a little later by **eurytheme** Bdv., which is not by any means common, and of which I have so far only taken males. It is scarcely necessary to mention such a cosmopolitan insect as **Danaus archippus** but for the fact that I have seen hibernated individuals early

in May, and venture to suggest that it may breed with us; it is abundant along the poplar-fringed bottom lands in certain years in July.

Of the **Satyridae** my collection shows few examples, but one butterfly among them well worthy of mention is **Oeneis macouni** Edw. Of this species I have a single example, which was taken near my house, but evidently a straggler, as it is a high altitude insect and is found more abundantly as we ascend to higher levels, together with **chryxus**, which is the commoner one of the two.

Among the **Nymphalidae, electa, leto** and **atlantis** are the commonest forms. **Brenthis bellona** is double-brooded with us, occurring in May and July. **Euphydryas perdiceas** Edw. occurs in great numbers in the spring.

Of the **Lycaenidae,** interesting and rather uncommon species are **Incisalia eryphon** Bdv., **C. dumetorum** Bdv., **H. heteronea** Bdv., and **P. piasus** Bdv.

Among the **Sphingidae,** a new record for British Columbia is **Smerinthus jamaicensis** form **geminatus** Say., which comes occasionally to light. **Paonias myops** A. & S. I have bred from the larva, the food plant of which is the choke cherry. **Pachysphinx modesta** Harris is taken sparingly. The beautiful **Proserpinus clarkiae** Bdv. is quite a common insect in certain years, flying in bright sunshine over the blossoms of the "wild sunflower." **Eubaphe immaculata** race **trimaculosa** Reak. is common some times on partly cleared bush lands. **Hyphoraia parthenos** Harr. is occasionally taken.

Among the noctuids, a new record for this Province is **Dysocnemis oregonica** Hy. Edw., which I have taken on the open range among the sunflowers in May. Sugaring I have always found the most successful method of getting noctuids and generally far more productive of specimens than light. One of the good things taken at sugar is **Euxoa andera** Sm., a new record for the Province; it is not uncommon. **Cirphis farcta** Grt., **Agrotis rubifera** Grt. and **Aplectoides condita** Gn. are also recorded for the first time; none of them are common in the district, and I obtained only single examples of each.

In August, 1915, several specimens of **Catocala relicta** Wlk. were obtained at sugar. This fine moth is usually rare with us, and it was the first time I had seen it for some years. It has the unusual habit of being attracted by ordure, and I have seen it fly up from cattle and horse manure on the roads. Other species of this genus that were taken are **nevadensis** form **montana** Beut. and **californica** Edw., the latter being the most common. Two specimens of **Eosphoropteryx thyatyroides** Gn. were taken in July, 1913, but I have failed to take it since. Others worthy of note are **Aplectoides pressus** Grt., **Euretagrotis perattenta** Grt., **Xylena mertena** Sm., **Trachea illocata** Wlk., **T. mactata**

race **allecto** Sm., **Luperina veterata** Sm., **Acronycta minella** Dyar., **A. tartarea** Sm. and **A. dolorosa** Dyar.

The Geometridae of the district are very numerous and although the species obtained by me were comparatively few, nevertheless two new records for the Province were obtained. These are **Macaria bicolorata** Fabr. and **Hesperumia sulphuraria** form **baltearia** Pack. Two specimens were secured of the latter, which is not at all uncommon. No collection was made of any Micro-lepidoptera.

With the exception of my own trivial and spasmodic efforts, the Northern Okanagan is quite unworked territory, and it is hoped that in the near future its insect fauna will be better known, there being no doubt that more sustained and systematic collecting will result in the discovery of many species hitherto unknown in the district.

For the determination of material, I am indebted to Mr. E. H. Blackmore, who has looked over my collection and given me most generous assistance.

NOTES ON THE HYBERNATION OF SOME LARVAE AND THE MOVEMENT OF BOREUS IN THE SNOW

By J. Wm. Cockle, Kaslo

The statement is often made that Snow Fleas, as they are commonly called, come up through the snow. This statement has often struck me as strange and altogether improbable. How could an insect get through several layers of frozen snow, which represent the results of thawing and are generally described as crusts? But like our old friend Mark Twain, "I have watched him." The summary of results follows:

The actions of the snow insects form a reliable barometer, and as they become readily visible after the first snow has whitened the ground, their observation becomes easy.

It is well to enumerate the changes that occurred in the temperature in order that we may more readily understand the extreme changes that insects are subjected to in this locality.

On November 17th, 1916, the winter commenced with a slight fall of snow and sleet, followed the next night by a fall in the temperature to below zero. The temperature gradually rose for the next few days, and then it snowed about six inches. The following morning, when the temperature stood at freezing point, the snow was covered with insect life. **Boreus californicus** was very numerous, and I also observed five species of spiders, the most plentiful of which is a pale greenish stone colour, having two yellow stripes lengthwise of the abdomen. I may note, in passing, that these spiders have been fairly common on the snow all winter, but the most remarkable thing that came under my observation was the number of noctuid larvae that were out on the surface of the snow, and were in a lively condition. The natural conclusion was that they had been caught by the early snow and although they had managed to crawl upward through it, away from the frozen ground below, that they would eventually succumb to the cold and find a grave in the snow, but remarkable as it may seem, their appearance later demonstrates that they will live and thrive in the snow. We had a continuance of cold weather and snow up to Christmas. On the night of the 26th December the temperature again fell to below zero, moderating again in a few days, and then another heavy fall of snow (making a total fall to date of 24 inches) with a temperature of 30 degrees. Numerous larvae were again seen in an active condition. I procured some five or six and brought them into the house and fed them on cabbage leaves. The change from the cold snow to the warmth of a sunny window in the kitchen seemed to be to their liking, and they were thriving well until they turned cannibals. Only one was left when I discovered this and I consigned it to the stove. Cannibal larvae will not reach maturity, but generally die just as they reach the stage of pupation.

Next time I shall know that they have to be kept separate, just as the snow deals with them.

Now let me describe nature's winter barometer—Boreus. When the temperature is 30 degrees or over they may be seen hopping over the snow, and if there is a snowstorm pending they will be observed in greater numbers. A heavy snowstorm starts, then they may be observed jumping from point to point in an endeavour to maintain themselves at the highest level. They do not get snowed under, but keep out on top as long as the temperature does not fall below 28 degrees.

As I previously stated, the temperature fell on December 26th to below zero. This was followed by a fall of 26 inches of snow and continuous cold for a fortnight, when the temperature again rose to 34 degrees. Within three days Boreus was again to be seen on the surface.

On February 1st a heavy snowstorm started, when 26 inches of snow fell in the course of 36 hours, and as the temperature was low, all insect life was dormant and consequently was buried under this depth of snow. No larvae were seen after this fall, but within three days Boreus was again out on the surface. In this way they follow up the various snowfalls, always keeping as near the surface as the temperature will permit.

Boreus also seems to avoid the extreme heat of the bright March sun. When the sun is shining they may be observed buried under a thin coating of the surface ice for protection against the heat. None will be visible on the surface except on cloudy days, or where there is some shade.

The summary of results is that they do come up through the snow, but they do it gradually, following up each fall as it occurs. It is probable that some of the noctuid larvae also pass the winter in a much similar manner but, as I have stated before, none have been seen since the heavy snow of December 26th.

How the spiders manage to exist I am not prepared to offer any suggestion, but from the fact that they may be observed on the surface of the snow when the weather is mild seems to offer the suggestion that their habits may be similar to the Boreus, or they may attach themselves to a tree or other similar resting place, a condition which does seem applicable to the other two insects mentioned, as the majority of those observed have been on or near the roads or on cleared land where there is no vegetation near, and their slow progression dispells the supposition that they have travelled any considerable distance during the time that the climatic conditions were sufficiently favourable for them to move about.

At the last annual meeting mention was made of another snow insect that I had discovered that was active when the temperature was 25 degrees Ft. I was fortunate in securing another of these this winter, which I found actively walking on the snow, the temperature being at the time 29 degrees Ft. As it was taken close to the house, I was able to compare the temperature at once. This makes this a positively reliable record.

NOTES ON GEOMETRIDAE NEW TO BRITISH COLUMBIA

By E. H. Blackmore, Victoria, B.C.

This is the fourth year in succession that I have presented you with a paper under a similar title. Each year I am in hopes that I have come to the end of the new additions to the list, but after another season's work, I always seem to find some species and varieties that have not been previously recorded.

The present paper embraces two species and eight varieties new to science that have been described during the past twelve months, and four species and three varieties new to British Columbia, making a total of six species and eleven varieties to be added to the list as a result of last year's investigations.

I will take the new species and varieties first.

Nomenia obsoleta Swett. When rearranging the collection of the late Captain R. V. Harvey, I came across three specimens that were labelled **Venusia cambrica** Curtis. Although bearing a strong superficial resemblance to this species they seemed rather small, and on further examination I found that they were all taken in April. Now as **cambrica** does not emerge until about the first of July, I knew at once that it could not be that species. Upon further examination under a microscope I found that in the males the antennae were somewhat different, being unipectinate, while in **cambrica** they are bipectinate and in **pearsalli** filiform ciliate. As they evidently did not belong to either of these two genera, they naturally fell into the genus **Nomenia,** which is closely allied. As we had no representative of this genus in British Columbia, I concluded that it was new and sent it to Mr. L. W. Swett, who verified my conclusions and named it **obsoleta.** This name is rather appropriate, as I have not seen it anywhere else with the exception of one in the Provincial Museum, which was taken in the same month and year—April, 1908.

I have worked this district thoroughly for the past five seasons, but have not taken anything approaching it, so that I am afraid it has disappeared.

Diastictis andersoni Swett. This species was taken by Mr. E. M. Anderson at Atlin, B.C., in 1914, and was at first thought to be a luteous form of **occiduaria** Pack., but the extra-discal lines are differently curved and there is no trace of any yellow shading. It is closely allied to **inceptaria** Walk., specimens of which I have from Michigan.

Hydriomena californiata ab **niveifascia** Swett. In Capt. Harvey's collection there were several specimens of **Hydriomena** under the name of **californiata.** On looking them over, I found two which were quite distinctive from the others, and which have been named as above. The chief points of distinction are the silvery white bands which replace the ordinary red shadings and smoky bands of the typical form.

PLATE II.

Fig. 5. **Xanthorhoe defensaria** form **gigantaria** Swett. (Paratype male).
Fig. 6. **Xanthorhoe defensaria** form **gigantaria** Swett. (Allotype female).
Fig. 7. **Xanthorhoe defensaria** form **conciliaria** Swett. (Paratype male).
Fig. 8. **Xanthorhoe defensaria** form **conciliaria** Swett. (Allotype female).
Fig. 9. **Xanthorhoe defensaria** form **thanataria** Swett. (Paratype male).
Fig. 10. **Xanthorhoe defensaria** form **thanataria** Swett. (Paratype female).
Fig. 11. **Xanthorhoe defensaria** form **mephistaria** Swett. (Paratype male).
Fig. 12. **Xanthorhoe defensaria** form **suppuraria** Swett. (Paratype male).

The above three insects were described in the Can. Ent., Vol. XLVIII., page 249 et seq. (July, 1916).

The next in order is the genus **Xanthorhoe,** a genus we have been working on for some considerable time. When I started to collect geometers seriously in the spring of 1912, I was much struck with the amount of variation that occurred in three species of this difficult but interesting genus. I determined to pay special attention to this group, with the result that in 1913 and 1914 I collected something over 300 specimens of this genus. The three groups mentioned are the **defensaria** group and what are known as the **fossaria-pontiaria** group and the **munitata-convallaria** group.

Taking the **defensaria** group first, I sorted them out into series governed by the date of their appearance and the differences in maculation. I then sent them to Mr. Swett, who agreed in the main with my separation, with the result that the following four well-marked varieties were described by him in the Can. Ent., Vol. XLVIII., page 349 et seq. (October, 1916).

X. defensaria var. **gigantaria** Swett, which is the large spring form occurring at the end of April. It is distinguished by its large size, heavy markings, and wide bands.

X. defensaria var. **conciliaria** Swett. This is a very distinct form and is easily recognized by the basal and outer areas of the fore wings being a deep ochre and the median band of a reddish chocolate colour. It flies along with, and at the same time as, typical **defensaria.**

X. defensaria var. **thanataria** Swett. This is a small and stunted form which occurs later in the fall, generally in September and October. It is possibly a third brood, but this cannot be definitely stated until it is bred. In fact, the whole of this group may have to be revised again, when the life histories of the various forms are worked out and the genitalia studied.

X. defensaria var. **suppuraria** Swett. This is a beautiful variety and a very distinct one, the broad black band contrasting sharply with the lighten ashen colour of the fore wings. This median band is subject to a variation in colour from reddish black to a deep jet black, and is really a melanistic form. This is the rarest of all the varieties and occurs in April.

I may say here that the study of the **fossaria-pontiaria** group has just been completed and three new species have been discovered, which will be described in the Can. Ent. at an early date. This leaves us the **munitiata-convallaria** group to work on during the present year, and which we hope to complete before our next annual meeting.

We now come to the **Dysstroma citrata-mulleolata** group. **Citrata** Linn and its varieties I treated of in our Proceedings No. 4, N.S., page 44 et seq., 1914, and **mulleolata** I spoke of in the paper I read before you

at our last annual meeting. A more complete revision of this group has just been given by Mr. Swett in the Can. Ent., Vol. XLIX., page 64 et seq. (February, 1917), wherein he has described the three following new aberrations:

Dysstroma mulleolata ab **sobria** Swett. This is a form which has the median band solid black and is the rarest form of all. So far I have only taken one specimen and that is the type which is in the collection of Mr. Swett.

D. mulleolata ab **subumbrata** Swett. In this form, which is a transition stage between the black-banded and the white-banded forms, the black central band has begun to break up into greyish spots and shadings, especially at the costal and inner margins. Of this form I took four specimens in 1914 and two in 1915, but have not seen it since.

D. mulleolata ab **ochrofuscaria** Swett. Of this form I have only taken one, and that is the type taken on the 27th June, 1915. Mr. G. O. Day took a female at Quamichan Lake in 1908, which has been made a paratype, as also is a male taken by Mr. A. W. Hanham in the same district in 1910. I believe Mr. Hanham has also one or two more of them.

I am not quite so sure of this latter being a variety of **mulleolata.** The course of the extra-discal line is different, and there are one or two other minor points which make me think that it may be a distinct species when its life history is worked out together with a study of the genitalia.

This concludes the list of species and varieties new to science which have been described from British Columbia during the past twelve months. Turning to those geometers which I have discovered during the past year as being new to British Columbia, the first to claim our attention is **Hydriomenia furcata** var. **periclata** Swett. I found this interesting geometer resting on the outside of my house on April 4th, 1916. It was described from a single male taken at San Francisco in 1909, and seems to be of very rare occurrence.

Stamnodes topazata var. **albida** B. & McD. where the deep ocherous colour of **topazata** gives place to a creamy white. This specimen was taken by our energetic librarian, Mr. Williams Hugh, and is rather illustrative of what is generally known as fisherman's luck. Mr. Hugh was over in Abbotsford for a few days in the early part of April last year, and one day seeing a few geometers flying about, he caught half a dozen with his hat, and brought them back with him in a matchbox.

Five of them were the common **M. gratulata,** and the other a new addition to the list. I am only sorry that the numbers were not reversed. Our thanks are due to Mr. Hugh for putting a new record on our lists in such a lucky manner.

Sciagraphia orillata Walk., taken by Mr. Anderson at Penticton on May, 1913. This was placed as a synonym of **continuata** Wlk. by Dr.

Dyar in 1902, but is a distinct species, a very excellent figure of which is given in Packard's Monograph, Plate IX., Fig. 75.

Sciagraphia meadiaria Pack., taken by Mr. W. Newcomb at Chilcotin in June, 1914. This one was rather damaged, but we are glad to have the record of it. This group sadly needs revising, but unfortunately our material in this group is very limited.

Macaria praeatomata Haw. This pretty species was taken by Mr. Downes at Armstrong in 1915. It is accurately figured by Packard in his Monograph on Plate X., Fig. 18. The name will probably fall before **bicolorata** Fab., as I believe the two species are the same. Packard had never seen a specimen of **bicolorata,** which was described from Virginia in 1794. **Praeatomata**, while not common, is widely distributed throughout the New England States.

Diastictis decorata Hulst. A specimen of this species was taken by Mr. Anderson at Lillooet in July, 1916. This species was described from specimens taken by Dr. Barnes at Platte Canyon, Colorado, in 1896.

Alcis sulphuraria var. **baltearia** Hulst. This pretty variety was taken by Mr. Downes in June, 1915, and also by Mr. Anderson at Lillooet, 27th June, 1916. I have specimens exactly like this one, taken at San Diego, Cal., in July.

This concludes the list of those that we are absolutely certain of as being new to British Columbia, although there are a few more yet to be correctly placed. We seem to have quite a number of intermediate forms in this Province, perhaps it would be better to say local races, and until these are bred and their life histories worked out, it cannot be definitely ascertained what their relationships are to closely allied species, appearing in other parts of the country.

Author's Note (July, 1918).—Since the above paper was written, many new facts have come to hand which makes it necessary to add the following notes and remarks:

Nomenia obsoleta Swett. On looking over the collection of Mr. G. O. Day, of Duncan, in September, 1917, I found that he had four specimens of this species amongst his material, all taken in the Duncan district. Showing how rare this species is, not more than one specimen was taken in any one year, the dates of capture being March 20th, 1914; April 16th, 1915; May 7th, 1916; and April 3rd, 1917. I was extremely glad to get these records, as I had feared that the species was extinct.

Xanthorhoe defensaria form **thanataria** Swett, and **Xanthorhoe defensaria** form **suppuraria** Swett. These two forms have both been placed in the synonymy by Messrs. Barnes and McDunnough in their New Check List. In the case of **thanataria** they are probably correct, as in my opinion it is only a partial third brood which is produced in those season's having a long, dry fall. The food plant at that time of the year being much less succulent, thus producing a small stunted form

with narrower bands. As regards **suppuraria** I must entirely disagree with them in placing it as a synonym of **mephistaria** Swett. They are seasonal forms, are quite distinct both in size and width of median bands, and I have never known them to intergrade. In my opinion **suppuraria** bears the same relation to **mephistaria** that **gigantaria** bears to typical **defensaria.**

Hydriemena furcata var. **periclata** Swett. There is some doubt as to the status of this specimen, either Mr. Swett has misidentified it, or the reference to **furcata** is incorrect. At the time I took the specimen in question I recognized that it was different to any that I had taken previously. I read over carefully the published descriptions of this group, and it seemed to me that it agreed very closely with **periclata.** At a later date I sent it to Mr. Swett, who confirmed my identification, remarking that "it is very nearly like type." Messrs. Barnes and McDunnough in "A Review of the genus **Hydriemena** Hub." (Cont. Lep. No. Amer., Vol. IV., No. 1), state that Mr. Swett has examined the unique male type (of **periclata**) and informs them that unfortunately the uncus is broken off but that the basal portion is rather narrow and suggests that of **furcata.** Recently I have examined my specimen under a binocular, and find that the uncus is of the shape which is characteristic of the **quinquefasciata** group, and which materially differs from the shape of the uncus in the **furcata** group. Until such times as further nimotypical specimens of **periclata** can be obtained, the reference to **furcata** cannot be considered as entirely conclusive. For the present I shall list it with a question mark as follows: **H. furcata** (?) var. **periclata** Swett.

Hydriemena californiata var. **niveifascia** Swett. Messrs. Barnes and McDunnough have associated this form with **irata** Swett, instead of **californiata** Pack., on account of the similarity of the male genitalia which differs considerably in the two species named. This variety is now known as **H. irata** form **niveifascia** Swett.

Dysstroma mulleolata Hulst. It is rather doubtful if our large Vancouver Island form is the true **mulleolata.** The type locality in Hulst's description is given as Colorado, whilst the type specimen in the Hulst collection at Rutger's College, N.J., is labelled "Washington," so it is questionable whether this so-called "type" represents the true **mulleolata** of Hulst. Again, Mr. Weiss who compared a specimen of the large Vancouver Island form with this so-called "type" (which is in very poor condition), may have misidentified it, as this large form, typical **truncata** Huf., and **citrata** form **punctum-notata** Haw. are practically alike in maculation. It is more than likely that the Hulst specimen, if the locality label is correct, is really conspecific with the latter-named form.

I wish to thank Mr. F. Kermode, our Honorary President and Director of the Provincial Museum, for the loan of the cuts, from which Plates II. and III. were made to illustrate this paper. E. H. B.

PLATE III.

Dysstroma mulleolata Hulst.
Victoria, B.C. (Blackmore)
(New to British Columbia.)

Dysstroma mulleolata form *subumbrata* Swett.
Victoria, B.C. (Blackmore)
(New to science.)

Dysstroma mulleolata form *ochrofuscaria* Swett.
Victoria, B.C. (Blackmore)
(New to science.)

Hesperumia sulphuraria form *baltearia* Hulst.
Armstrong, B.C. (Downes).
(New to British Columbia.)

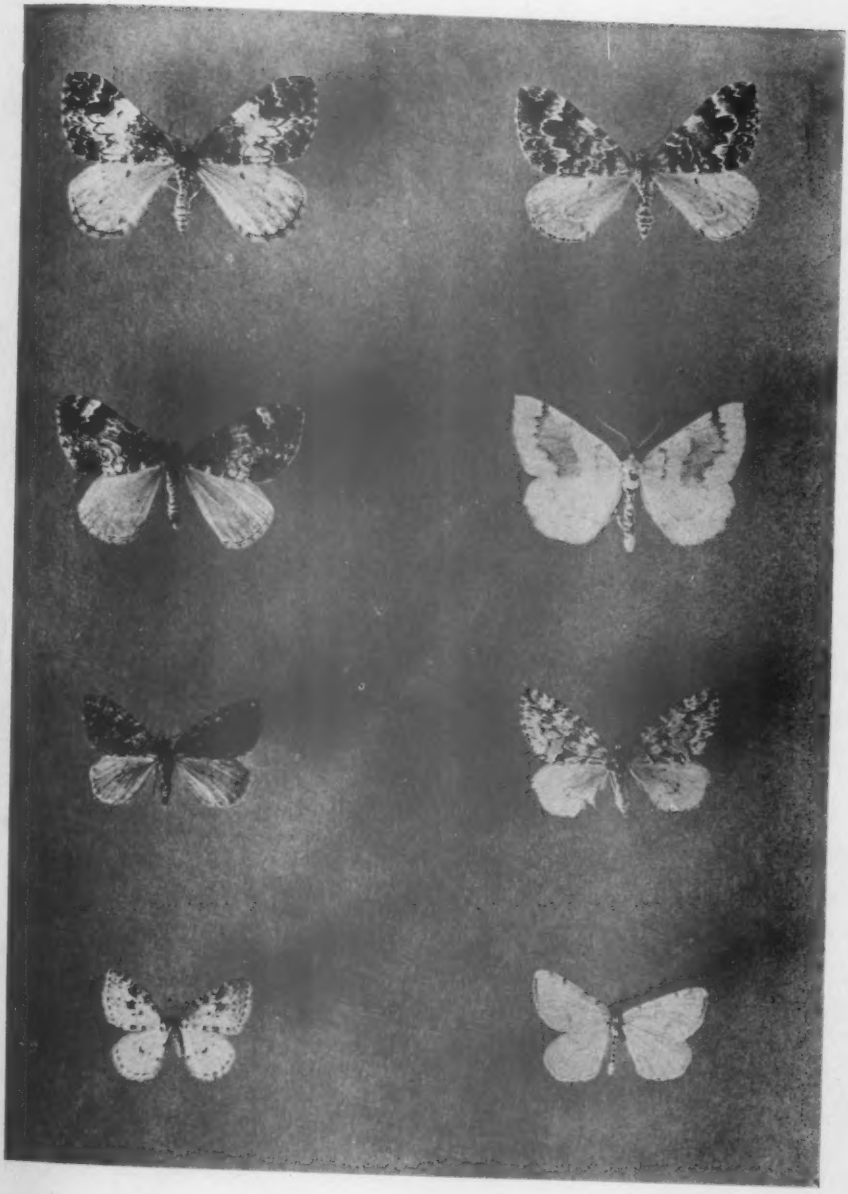
Hydriomena furcata race *periclata* Swett
Victoria, B.C. (Blackmore)
(New to British Columbia.)

Hydriomena irata form *niveifascia* Swett.
Victoria, B.C. (Harvey coll.).
(New to science.)

Venusia obsoleta Swett.
Goldstream, B.C. (Harvey coll.).
(New to science.)

Itame andersoni Swett.
Atlin, B.C. (Anderson).
(New to science.)

PLATE III.



FOSSIL INSECTS, WITH SPECIAL REFERENCE TO THOSE OF THE TERTIARY LAKE DEPOSITS OF THE SIMILKAMEEN VALLEY, B.C.

By Alfred E. Cameron, M.A., D.Sc., F.E.S.

MEANS OF FOSSILIZATION

Abundant as insects are at present, they are comparatively rare as fossils, the fossil species forming a very insignificant percentage of the total number of described species of insects. The absence of insect remains in sedimentary rocks of marine origin is explained by the fact that almost no insects inhabit salt water; and terrestial forms, in general, are ill-adapted for fossilization. The hosts of insects that die each year leave remarkably few traces in the soil, owing perhaps in great measure to the dissolution of chitin in the presence of moisture.

Most of the fossil insects that are known have been found in vegetable accumulations such as coal, peat, lignite, or else in ancient fresh water basins, where the insects were probably drowned and rapidly embedded. At present, enormous numbers of insects are sometimes cast upon the shores of our great lakes—a phenomenon which helps to explain the profusion of fossil forms found in some of the ancient lake basins.

Insects in rich variety have been found in amber, the fossilized resin of coniferous trees. This substance, as it exuded, must have entangled and enveloped insect visitors, just as it does at present. Many of these amber insects are excellently preserved, as if sealed in glass. Copal, a transparent amber-like resin from various tropical trees, particularly Leguminosae, has also yielded many interesting insects.

Ill-adapted as insects are by organization and habit for the commoner methods of fossilization, the number of fossil insects already described is now more than 6000.

LOCALITIES OF FOSSIL INSECTS

The Devonian of New Brunswick in Canada has furnished a few forms, found near St. John, in a small ledge that outcrops between the tide-marks. These forms, though few, are of extraordinary interest, as will be seen.

For Carboniferous species, Commentry in France is a locality noted through the admirable researches of Brongniart (6), who described from there 97 species of 48 genera, representing 12 families or higher groups —10 of which are regarded as extinct—without including many hundred specimens of cockroaches which he found but did not study. In this country many species have been found in the coalfields of Illinois, Nova Scotia, Rhode Island, Pennsylvania and Ohio.

Many fine fossils of the Jurassic period have been found in the lithographic limestones of Bavaria. One hundred and forty-three species from the Lias—four-fifths of them beetles—were studied by Heer (1).

The Tertiary period has furnished the majority of fossil specimens. To the Oligocene belong the amber insects, of which 900 species are known from Baltic amber alone, and to the same epoch are ascribed the deposits of Florissant and White River in Colorado and of Green River, Wyoming. These localities—the richest in the world—have been made famous by the monumental works of Scudder. At Florissant there is an extinct lake, in the bed of which, entombed in shales derived from volcanic ash and sand, the remains of insects are found in astonishing profusion. For Miocene forms, of which 1550 European species are known, the Oeningen beds of Bavaria are celebrated as having furnished 844 species, described by the illustrious Heer (1).

On our Western Coast it is interesting to know that quite a rich stratum of fossil-insect remains are located in the Tertiary lake deposits of the Southern Interior of British Columbia, there being in all something like 135 species, which have been described by the three distinguished palaeoentomologists, Scudder, Cockerell and Handlirsch. In 1910 Handlirsch (2), dealing with a collection of 73 specimens of fossil insects disinterred by Lambe of the Canadian Geological Survey, and submitted to him for investigation by Dr. A. P. Low, Director of the Survey, made a valuable contribution to the study of Canadian fossil insects. The localities in which these insect fossils of British Columbia have been found is confined to a comparatively small area, extending from the Similkameen in the south to Quesnel in the north, and include the deposits along the Nicola River, the Tulameen River one and a half miles above Princeton and opposite Vermilion Cliff, Tranquille River, Horsefly Mine, Ninemile Creek, Quilchena. One specimen is recorded from Vancouver Island, an unidentified specimen of the Chrysomelid genus Microrhopala described by Chagnon.

Of the 73 specimens collected by Lambe, Handlirsch distributed them among the systematic groups as follows: Orthoptera (Acridioidea), 1; Coleoptera, 4; Hymenoptera—Ichneumonidae, 1; Rhaphidioidea, 1; Diptera—Bibionidae, 54; Ptychopteridae, 1; Tipulidae, 2; Empidae, 1; Hemiptera—Pentatomidae, 1; Gerridae, 1; Homoptera—Cercopidae, 3; Insecta incerta sedis, 6. In all there were 41 species, of which 20 belonged to the genus Penthetria of the dipterous Bibionidae.

Including the Tertiary insects previously made known from British Columbia, chiefly in the works of Scudder—which Handlirsch (2) for the sake of completeness inserted in his list—the species are systematically distributed among various families by this author as follows:

Orthoptera—Acridioidea, 1. ? Mastacinae, 1.

Coleoptera—Carabidae, 1; Nitidulidae, 1; Tenebriondidae, 1; Elateridae, 5; Buprestidae, 3; Hydrophylidae, 1; Chrysomelidae, 3; Scarabaeidae, 1; Coleoptera incertae sedis, 3.

Hymenoptera—Ichneumonidae, Pimplinae, 4; Braconidae, 2; Formicidae, 3.

Neuroptera—Hemerobiidae, 1.

Diptera—Orthorrhapha nematocera, Mycetophilidae, 5; Bibionidae, about 35; Ptychopteridae, 1; Chironomidae, several; Tipulidae, 2; Orthorrapha brachycera, Asilidae, 1; Empidae, 1; Dolichopodidae, 1; Cyclorrhapha-Borboridae (Acalyptrate Muscidae), 5; Anthomyiidae, 2.

Hemiptera—Gerridae, 2; Pentatomidae, 2.

Homoptera—Fulgoridae, 1 (? 2); Cercopidae, 12; Aphididae, 2 (incerta sedis, 1).

Insecta incerta sedis, 7.

With such a small number of species as have been found, it is difficult to judge accurately the age of the given deposits. Handlirsch argues that since no representatives of the latest and most highly specialized insects have been found, the deposits belong to the early Tertiary. For instance, the Aphididae, Muscidae, Syrphidae, Rhynchophora, Cecidomyiidae, Lepidoptera, Thysanoptera, Termitidae, Forficulidae, Chalcididae, etc., are either absent or only feebly represented, and likewise the Lamellicorns and Formicidae. All these groups have doubtless persisted since the Cretaceous. Nevertheless, in the early Tertiary they did not for a long time attain that pre-eminence for which they were noted in the late Tertiary, the Quaternary, and especially in recent times, where they are distinctly dominant forms. In the early Tertiary they were certainly also well represented in British Columbia, and, if they are lacking in the collections, this fact must in part be attributed to accident, and in part to their still meagre numerical development at that time. Moreover, this fact may also be accepted as proof of the relatively great age of the beds in question. A further argument of perhaps greater significance, rests on the relatively strong representation of groups of Old-world forms, as, for example, the Elateridae and Buprestididae (which were numerous even in the Lias); the species of the genus Pimpla, belonging to the most primitive apocrite Hymenoptera; the Cercopidae, which are also of Jurassic age; also a form of Acridiidae, which does not strictly coincide with any of the recent sub-groups; a Rhaphidian in which are found characters of both existing genera of this order, and, finally, a very primitive Ptychopterid, the representative of a family existing today in a few surviving forms.

The Diptera clearly furnish the most reliable data. Of these forms, the nematocerous Orthorrhapha with their eucephalous larvae, also the above-mentioned ptychopterid, as well as the Chironomids, Myceto-

philids, and Bibionids, have a relatively strong representation, and outnumber all other Diptera threefold. Today, these conditions are exactly reversed. The Bibionids were especially prominent, and appear to have formed the principal element of the fauna of that time. They are exclusively represented by the genus **Penthetria (Plecia),** which throughout the world, at present, includes but few more species than are comprised in the small collection of Lambe. The number of species of this genus was much larger in the early Tertiary than in the late Tertiary, where the genus **Bibio** was beginning to become more prevalent, as judged by their geological distribution in the European Tertiary. Hence Handlirsch came to the conclusion that the occurrence of so disproportionately large a number of species of **Penthetria** in the Tertiary of British Columbia, contemporaneous with the absence of **Bibio,** also indicate that the beds in question belong to the early Tertiary, and are at least Oligocene in age. The genus **Bibio** is now represented in the American Tertiary and the supposition is that the genus **Bibio** originated in the East, probably in Europe, and later found its way to America. Today, the genus **Penthetria** exists principally in tropical and subtropical countries. In temperate zones, it survives only in individual forms; one of these being the single dwarf European species **P. holosericea. Bibio,** on the other hand, is especially abundant in the temperate regions of North America and Europe, but is sparingly represented in the South. So much the more interesting, then, is the occurrence of such a large series of fossil species of Penthetria—the representatives of existing thermophilous forms—in a latitude so high as is the region of the Similkameen River. Not only in the Penthetrias, however, but also in **Promastax** (primitive Acridioid) and the numerous Cercopids, and particularly in the huge **Aphrophora angusta** Hand, the fulgorid, **Ricania antiquata** Scud, etc., are found proofs of a warm climate at that time. These data, therefore, taken together, lead to the safe conclusion that the Similkameen deposits are at least Oligocene in age.

GEOLOGICAL RECORD

Although insects have a very long pedigree, it is as yet a very imperfect one. The remains of creatures that can be referred to the class Insecta have been found, it is said, in Silurian strata; only one or two of these very early forms are at present known, and the information about them is by no means satisfactory. If insects at all—as to which some doubt exists—they apparently belong to very different forms, though, like all the earliest fossil insects, they are winged. In the strata of the Carboniferous epoch numerous insects have been detected, in both Europe and North America. These early insects are called by Scudder—quoted by Sharp (8, p. 486)—Palaeodictyoptera. According to this author they are separated from the insects around us, because he considers there existed among the Palaeozoic insects no ordinal distinctions such as obtains in the existing forms, but that the

primeval creatures formed a single group of generalized Hexapods. Brauer on the other hand—also quoted by Sharp (8)—considers that these earlier forms can be relegated to families existing today and forming parts of the Orthoptera, Neuroptera and Hemiptera. Since it is chiefly the wings of these forms that have been found, it would seem arbitrary to assign the species to a separate order, said to be extinct, on merely alar evidence. The fact that there is one species, **Eugereon bockingi,** with head and mouth parts of a hemipterous or dipterous nature while the wings are distinctly neuropetrous, seems to us to weaken Scudder's position.

In the more recent rocks, insect remains become comparatively numerous, and in Mesozoic strata forms that can be satisfactorily referred to existing orders are found, the Palaeodictyoptera of Goldenberg and Scudder having disappeared. The Blattidae do not apparently present any great discontinuity between their Palaeozoic and Mesozoic forms. It would be well to remark here that the history of the cockroaches is the best preserved in the rocks, of any insect. In the Carboniferous epoch they existed in considerable numbers and variety, and a still earlier but doubtful fossil has been found in the Silurian of Calvados. It is curious to note, according to Brongniart (6), that some of the females of these fossil Blattidae had a well-marked ovipositor, in the shape of an elongate, exserted organ at the end of the body, by means of which the insect may have desposited its eggs in trees and other receptacles in the manner prevailing among Orthoptera of our own times.

In the strata of the Secondary epoch, remains of Blattidae have also been discovered in both Europe and America, in Oolitic, Liassic and Triassic deposits. From the Tertiary strata, on the other hand, comparatively few species have been brought to light. A few have been discovered preserved in amber.

According to Scudder (5, p. 109) not only were insects abundant in the Tertiaries, but their remains indicate conditions of existence very similar to what we find around us today. "Certain peculiarities of secondary sexual dimorphism accompanying special forms of communistic life, such as the neuters and workers in Hymenoptera and the soldiers of the Termitidae, are also found, as would be expected, among the fossils, at least through the whole series of the Tertiaries. The same may be said of other sexual characteristics, such as the stridulating organs of the Orthoptera, and the peculiarities of ovipostion, as seen in the huge egg-capsules of an extinct Sialid of the early Tertiaries. The viviparity of the ancient Aphididae is suggested, according to Buckton, by the appearance of one of the specimens from the Oligocene of the Florissant, while some of the more extraordinary forms of parasitism are indicated at a time equally remote by the occurrence in amber of the triangulin larva

of **Meloe** and of a characteristic strepsipterous insect. Not only, too, are the parent tribes of gall-making insects abundant in the Tertiaries, but their galls as well have been found."

Following is a brief outline of our knowledge of fossil insects as culled from Folsom (9):

Phryganeidae. Abundant remains in the Tertiaries. It is a remarkable fact that a larval case has been found in amber, which seems to point to the arboreal habits of the species, quite rare today. Adult fossils are very abundant at Florissant (Tertiary Lake Basin). In Auvergne, the so-called industrial limestone, two or three yards thick over a wide area, is supposed to be composed chiefly of the cases of larvae of this family.

In the Mesozoic epoch some wings have been found in the lower Purbeck, and similar wings in the Lias. A tube of a supposedly Phryganeid larva has been found in the Cretaceous of Bohemia. The palaeontological evidence does not appear to supply any information regarding the theory that the Phyrganeidae are allied to the early conditions of the Lepidoptera.

Acridiidae. Have never been found in amber, probably owing to their strength and size. Few fossil remains are known and these do not extend further back than the Mesozoic. Several forms found at Florissant. Brogniart has found some representatives at Commentry in the Carboniferous strata (Palaeacridiidae), which are said to be abundant in this epoch.

Forficulidae. Occur in the lower Lias of Aargau and Jurassic in Eastern Siberia, but the forms are not well preserved. They are common in the Tertiary formations, as in the Lower Miocene beds at Florissant.

Ephemeridae. The palaeontological record of this family is both rich and remarkable. Several forms are preserved in amber. The family is represented in the Tertiaries (Florissant), Jurassic, Devonian and Carboniferous, all more or less akin to our existing Ephemeridae. All evidence points to the fact that our fragile, short-lived may-flies appear to be, as Scudder says, the lingering fragments of an expiring group.

Perlidae. Occur in amber, Eocene (Isle of Wight); Miocene (Europe); Jurassic (Siberia); Carboniferous (Commentry).

Sialidae. Found in Tertiary and Mesozoic. The red sandstones of Connecticut have yielded a larval form of Sialid (Scudder), which is the oldest larva known (**Mormolucoides articulatus**). From the Carboniferous of Illinois several specimens have also been disinterred.

Termitidae. Very abundant in Tertiary times, when the genera appear to have been much the same as at present. In Mesozoic strata,

the remains of true Teremitidae apparently exist in the Lias in Europe, but further back than this the history is not traceable satisfactorily. They are not now supposed to have existed in the Carboniferous strata.

Some of the extinct Neuroptera of palaeozoic times were insects of large size, surpassing considerably in this respect any of those now known. Some possessed abdominal tracheal gills comparable to those found in the immature condition of the present day Ephemeridae and analogous to those of the adult of **Pteronarcys.** Further, some had wing-like expansions on the prothorax.

Thysanoptera. Tertiary epoch of Europe and North America.

Buprestidae. Remarkably rich in fossils. Twenty-eight per cent. of fossil beetles of the Mesozoic period found by Heer in Switzerland are referred to the Buprestidae.

Diptera. A considerable variety of forms have been found in amber and many in the Tertiary beds. A very few numbers of the Cyclorrhaphous sections are, however, found among them. Tipulidae are richly represented. In the Mesozoic epoch the order is found as early as the Lias, the forms being exclusively Orthorrhaphous, both Nematocera and Brachycera being represented. All are referred to existing families. No evidence has been found tending to connect the Diptera with other orders. No Palaeozoic Diptera are known.

Hemiptera. Several Palaeozoic fossils have been found but their identity has been disputed. **Eugereon bockingi** belongs to the Permian strata. Facts show that the Homoptera appeared before the Heteroptera and date as far back as the Carboniferous period.

Ants. They are among the earliest of the Hymenoptera. Remains referred to the family have been found in the Lias of Switzerland and in the English Purbecks. In Tertiary times Formicidae appear to have been the most abundant of all insects. At Florissant they occur in thousands and form in individuals about one-fourth of all the insects found there. They have also been met with in large numbers in the European Tertiaries, and Mayr studied no less than 1500 specimens found in amber.

Oestridae and other parasites (Mallophaga). Although in many cases the rocks have yielded us no direct information regarding such highly specialized parasitic insects as the warble flies of oxen and deer, we may be assured that they only became differentiated during those later stages of the Kainozoic period which witnessed the evolution of their respective mammalian hosts. Carpenter (7, p. 108) states that "some instructive hints as to differences in the rate of change among different insect groups may be drawn from the study of parasites." For example, V. L. Kellog (10) points out that an identical species of the

Mallophaga (Bird Lice) infest an Australian Cassowary and two of the South American Rheas; while two species of the same genus (**Lipeurus**) are common to the African Ostrich and a third kind of South American Rhea. These parasites must have been inherited unchanged by the various members of these three families of flightless birds from their common ancestors, that is from early Kainozoic times at latest.

Handlirsch (4, p. 250) has shown in a summary of the distribution of the species of existing and extinct genera of insects that heterometabolus species are more numerous in warm regions, whilst holometabolic species are more frequent in cold countries. Arguing from this fact, we are led to the conclusion that those species, the fossil remains of which are found in the rocks of temperate regions, but are related to forms which today occur only in warm, southern countries, must have existed at a time when temperature conditions were more favourable in those regions where they now occur only as fossils. In amplification of the evidence Handlirsch (3, p. 518) cites several cases and I take the opportunity of presenting a translation of his words:

"The sand-ground beetle, **Tetracha carolina,** occurs today only in the southern part of North America and in Central America, but it is also found in the European Bernstein. The sawflies of the genus **Perga** exist today only in Australia and sparingly in South America. They were, however, present in the Miocene of North America. The Aethiopian genus **Glossina** (tse-tse flies), fortunately now only represented in tropical Africa, but they were present in the Miocene of North America. The nemopterid genus **Halter** is now confined to the Eastern Mediterranean, whereas species abounded in North American Miocene. Various genera of ants which one finds today only in tropical Asia, lived in the Oligocene in Northern Europe.

"Not only do these fossil remains indicate a similarity in the environmental conditions of the regions where they occurred thousands of years ago with those that now prevail in those regions where their allies at present live, but it is more than probable that there was distinct land connections between the different continents in places now occupied by the waters of the ocean.

"It appears to me that generally speaking insects offer very good evidence for the assumption that the northern continents were linked up at different times to each other by means of land-bridges, for there was in the Palaeozoic a great resemblance between the faunas of the eastern and western hemispheres. All orders of which we have been able to recognize more than one representative, have been shown to occur both in America and Europe. Almost all families tolerably rich in species, and many genera occur on both sides of the Atlantic, and although the species often appear to be different, yet the difference in the general facies of the faunas is certainly not any greater than that

which prevails today in the case of those of Europe and Palaarctic Eastern Asia. Since there was also a similar condition of affairs in the Tertiary, we may conclude that insects were repeatedly given the opportunity of passing between Eurasia and North America."

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In Memoriam

TOM WILSON

It is with a feeling of deep regret that I put pen to paper to record the life-work of our late lamented colleague and friend, Mr. Tom Wilson, who met his death in a disastrous fire at the Coquihalla Hotel at Hope, B.C., on March 6th, 1917. On the other hand, it is with immense satisfaction that I can call attention to the wonderful influence his life and personality brought to bear on the work of our Entomological Society, as indeed upon the interests of all field naturalists. His intimate knowledge of our birds, mammals, plants and insects was nothing short of marvellous, and it was conceded by all who knew him that he represented the best type of field naturalist the Province has enjoyed for a great many years. He could discourse freely upon the habits of many native animals and insects—facts known to only a few but facts learnt by observation and experience—and he could bring his memory to bear onto the distribution of the majority of our native plants and trees. There were few parts of British Columbia where he had not been, after thirty years sojourn in the Province. While the habits of insects and animals attracted his regard to no small extent, it was really upon the mysteries of plant life, growth and ecology, that his mind really loved to dwell. A tramp through the woods, especially on Vancouver Island and on the Lower Mainland, was to his heart its greatest pleasure, and hours spent in his company on such occasions were hours of inspiration and delight.

He was born at Musselburgh, Scotland, on July 25th, 1856. In his early twenties he studied horticulture and forestry, and for a while was employed as foreman in the Royal Botanic Gardens at Edinburgh. India then claimed his attention, to which country he went at the age of 24. Here he was engaged as Superintendent of some tea plantations in Lower India and Burmah. After six years spent in the tropics, he returned to his home in Scotland, only to set sail shortly afterwards for Canada. He was for a time employed on railway construction work on the main line of the Canadian Pacific Transcontinental Railway, and as he used to remark, "he walked into British Columbia before the railway was completed." From 1886 until the date of his death he remained in British Columbia—in very truth one of the pioneers of this great Province. In 1896 he was appointed Fruit Inspector in the Provincial Department of Agriculture. In 1900 he entered the service of the Dominion Government as Superintendent of Fumigation, and in 1906 the Inspectorship of Indian Orchards was added to his duties. The importance of the work necessary to develop Indian agriculture grad-

THE LATE MR. TOM WILSON,

Dominion Inspector of Indian Orchards
President, Entomological Society of British Columbia, 1912

ually increased until finally, in 1911, he was relieved of his work at the Fumigation Station in order that he might devote his whole energy to the improvement of Indian orchards and farms.

It was in pursuit of his duties as an officer of the Indian Department, loaned to the Entomological Branch of the Dominion Department of Agriculture, that he met his untimely end on March 6th, 1917.

The most outstanding feature of his character was his absolute trust and loyalty to his colleagues and to his chiefs, and his obvious endeavour to do the very best he could in the work in which he was engaged. Friends throughout the Province learnt of his death with the greatest regret, realizing a sterling character had passed away as well as a perfect friend and companion.

R. C. TREHERNE, B.S.A.